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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/006,578      | 12/06/2001  | Manoj K. Jain        | TI-31858            | 4968             |

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| EXAMINER |
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LE, THAO X

|          |              |
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| ART UNIT | PAPER NUMBER |
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2814

DATE MAILED: 06/20/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application N .

10/006,578

Applicant(s)

JAIN, MANOJ K.

Examiner

Thao X Le

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 April 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-16 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-16 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1, 3, 9-11, are rejected under 35 U.S.C. 102(e) as being anticipated by US Patent 6291340 to Sandhu et al.

Regarding to claim 1, Sandhu discloses a method of forming a conductive structure in an integrated circuit in Fig. 1, comprising the steps of: forming a dielectric layer 32, column 6 line 57, over a semiconductor body, forming a hole 31, column 6 line 65, fig. 3, in dielectric layer 32, forming a conductive liner 35, column 7 line 1, in hole 31, annealing conductive liner, treating conductive liner with hydrogen, column 7 lines 16-22, forming a conductive barrier 41, column 7 line 13, fig. 4, after treating the conductive liner with hydrogen, filling hole 131 with a conductive material 62, column 7 line 30.

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Regarding to claim 3, 10-11, Sandhu discloses a method of forming a conductive structure wherein annealing and treating steps are performed simultaneously, and the treating step is performed after etching and before filling step, column 7 lines 16-22.

Regarding to claim 9, Sandhu discloses a method for forming a contact in an integrated circuit, comprising the steps of: forming a dielectric layer 32, column 6 line 57, over a semiconductor body, etching a contact hole 31, column 6 line 65, fig. 3, extending through dielectric layer 32, deposited titanium 35, column 7 line 1, in hole 31, over dielectric layer, including on exposed surface with contact hole, annealing titanium, treating titanium with hydrogen, column 7 lines 16-22, deposit TiN 41, column 7 line 13, fig. 4, over titanium, and then filling contact hole 131 with a tungsten 62, column 7 line 30.

***Claim Rejections - 35 USC § 103***

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 4-8, 12-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 6291340 to Sandhu et al in view of US Patent 6335282 to Sharan et al

Regarding to claims 4-7, 12-15 Sandhu discloses the method wherein the hydrogen-containing atmosphere comprises pure hydrogen or, column 7 line 17.

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But Sandhu do not expressly discloses a method of forming a conductive structure wherein treating step comprises a plasma treatment in the hydrogen mixed with carrier gas comprises ammonia.

However, Sharan reference discloses a method of forming a conductive structure wherein treating step comprises a plasma treatment in hydrogen mixed with carrier gas comprises ammonia, column 4 line 40 and 47. At the time of the invention was made; it would have been obvious to one of ordinary skill in the art to combine the teaching of Sharan with Sandhu, because it hydrogen containing plasma to form titanium nitride is conventional in the art. Furthermore, such TiN formation also confirms in US 6146991 to Cheng et al.

Regarding to claims 8, 16, Sandhu and Sharan do not expressly discloses a method of forming a conductive structure further comprising the step of repeating treating step prior to filling step.

However, as discussed in claims 4 and 7 hydrogen plasma containing ammonia to form titanium nitride (TiN) is well known in the art. Repeating this hydrogen plasma treatment process is to form a desired thickness of TiN, Accordingly, it would have been obvious to use teaching of Sharan and Sandhu in the repeating step as claimed, because it has been held that where the general conditions of the claims are discloses in the prior art, it is not inventive to discover the optimum or workable range by routine experimentation. See In re Aller, 220 F.2d 454, 105 USPQ 233, 235 (CCPA 1955).

***Response to Arguments***

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5. Applicant's arguments filed on 04/30/03 have been considered but are moot in view of the new ground(s) of rejection.


***Conclusion***

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao X Le whose telephone number is 703-306-0208. The examiner can normally be reached on M-F from 8:00 AM - 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael M Fahmy can be reached on 703-308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Thao X. Le  
June 11, 2003

  
PHAT X. CAO  
PRIMARY EXAMINER